



ISSN: 0975-833X

Available online at <http://www.journalcra.com>

INTERNATIONAL JOURNAL
OF CURRENT RESEARCH

International Journal of Current Research
Vol. 4, pp. 062-069, May, 2010

RESEARCH ARTICLE

DIVERSITY, BIOLOGY AND ECOLOGY OF SEA SNAKES (HYDROPHIIDAE) DISTRIBUTED ALONG THE PARANGIPETTAI COAST, SOUTHEAST COAST OF INDIA

Damotharan, P*, Arumugam, M., Vijayalakshmi, S. and Balasubramanian, T.

Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai – 608 502.
Tamil Nadu, India.

ARTICLE INFO

Article History:

Received 12th April, 2010

Received in revised form

15th April, 2010

Accepted 17th April, 2010

Published online 2nd May, 2010

Key words:

Sea snakes;
Distribution;
Biology;
Ecology

ABSTRACT

Sea snakes are venomous elapid snakes which inhabit marine environments for most or all of their lives. They are found in warm coastal waters from the Indian Ocean to the Pacific. Most sea snakes are completely aquatic and have adapted to their environment in many ways, the most characteristic of which is a paddle-like tail that has increased their swimming ability. The aim of the present study is to assess the diversity, biology and ecology of sea snakes (Family: *Hydrophiidae*) occurring in the Parangipettai coastal region, Southeast coast of India. It revealed the presence of ten species included in five genera. There is no detailed study on above aspects of sea snakes of Parangipettai. Hence, the present study was undertaken in this coast.

© Copy Right, IJCR, 2010 Academic Journals. All rights reserved.

INTRODUCTION

Sea snakes are found primarily in tropical waters. They are marine reptiles and comprise about 86% of living marine reptiles species. They are cold-blooded, usually scaly vertebrates and breathe by lungs (Sedgwick, 1905). Class *Reptilia* consists of four orders, which are Crocodylans, *Testudines*, *Squamata* and *Rhynchocephalia* (*Sphenodontia*). Coming under the order *Squamata*, the snakes have a long elongated body and covered with scales and the tail is proportionally short (Verma and Pandey, 2004). Though external limbs are absent, but vestiges of limbs are found in the barbarous snakes (Sedgwick, 1905). Sea snakes are closely allied to both the terrestrial cobras and kraits and, to a greater, to the Australian elapids. In fact, it should be pointed out that some workers believe that modern sea snakes arose independently at least twice (there are amphibious sea kraits and there are totally marine sea snakes) and that both group of sea snakes are members of the *Elapidae* family (Karthikeyan and Balasubramanian, 2007).

As a major marine reptilian group, the sea snakes are found mainly in tropical and subtropical waters (Tu, 1988). Probably it is the most abundant reptiles on earth (Auerbach book). The sea snakes are distinguished from the land snakes by their laterally compressed fin-like tail. Sea snakes comes under family *Elapidae* with two subfamilies, they are *Hydrophiidae* and *laticaudinae*. *Hydrophiidae* are the true sea snakes it has tail flattened laterally and the shields on the head large and symmetrical.

All have valvular nostrils on top of the snout upwards and can close tightly to exclude water (Gow, 1977). The subfamily *Laticaudinae* is the amphioxus sea snakes considered more primitive (e.g., closer to the original elapid ancestors). These sea snakes forage at the sea but return to land to mate (Shetty and Shine, 2002). *Laticaudinae* has well developed ventrals of one third to more than one-half the breadth of the body compare to *Hydrophiidae* and it only genus laying eggs on the land. The sea snakes are represented; according to different authors, the number of species ranges from 16 genera 46 (Lim and Lee, 1989), 50 (Smith, 1926), 51 (Voris, 1972), 52 (Tu, 1988) and 60 species (Murthy, 1999). Indian waters are known to harbour about 25 species with the report of 11 species in Gulf of Mannar region (Karthikeyan *et al.*, 2008) and two along the West coast of India (Lobo *et al.*, 2004). Although sea snakes are commercially exploited for various applications in Philippines, Australia, Japan, Taiwan, Thailand (Rasmussen, 2001) and other coastal areas which considered nuisance species.

Sea snakes show seasonal movement between inshore and offshore waters either in search of food or for bearing young (Shuntov 1971, Wassenberg *et al.*, 1994, Fry *et al.*, 2001) suggested that the females of most species appear to be gravid in the summer, and presumably bear young towards the end of this period in Australian waters. Sea snakes form an important constituent in the marine environment as they occupy a high position in the food web, feeding upon various finfish and invertebrate species (Glodek and Voris 1982, Heatwole 1999). In addition, sea snakes interact with other marine organisms through

*Corresponding author: damotharanp@gmail.com

symbiotic interactions. For example, sea snakes are reported to be fouled by barnacles (Reynolds and Pickwellm, 1984) and other marine organisms (Dunson 1975, Zann *et al.*, 1975)

Two harmless species, *Acochordus granulatus* and *Cerberus rhynchops* bears a strong superficial resemblance to some of the sea snakes of *Elapidae*, particularly in its color and markings. Also marine, it is distinguished by the peculiar skin and head escalation, in which the scales are minute and granular, irregularly arranged. Although its tail is slightly flattened from side, it does not have the paddle shaped tail from characteristic of the marine elapids. It is brown with pale grey cross bands, some of which do not meet over the back. It is coming under non-poisonous snakes. Occasionally the nontoxic estuarine snake distributed in the sea, for example *Cerberus rhynchops*. (Karthikeyan and Balasubramanian, 2007).

Sea snakes display considerable variations in size, colour and behavior. Many of them are more or less sharply marked with alternate light and dark bands of different colours (usually black or shades of brown, grey or yellow). The bands may encircle the body completely or partially. Large specimens grow up to 3 m, but smaller ones seldom exceed 1.3 m. The transverse ventral shields found in most land snakes are totally absent in most sea snakes; *Hydrophiidae* snakes have small ventral, not more than one-quarter the breadth of the body (Haile, 1958 and Tweedie, 1941).

The sea snakes are the most venomous reptilian group in the world and their venoms are more toxic than that of the terrestrial snakes. However, they are rarely aggressive or menacing. Bites have become unusual with the advent of modern fishing methods (Senanayake *et al.*, 2005), but potentially serious hazard of the marine environment as their venom contain potent neurotoxins, more lethal than the venoms of many terrestrial snakes (Tu, 1987, Acott and Williamson, 1996). But the venom has biologically active compounds (Yang *et al.*, 2005 and Mora *et al.*, 2005).

Sea snakes are known for the neurotoxic venom and valuable skin and now their exploitation is protected under Wild Life Protection Act, 1972 of the Indian Government. The studies on sea snakes have been accorded insufficient attention thus far. Interest in the sea snakes has grown noticeably in recent years for their most powerful animal toxins (Murthy, 1977) and their role in marine food chain (Voris, 1972, Voris and Voris, 1983). This overview is by no means an exhaustive account of the subject, but it does present a brief synopsis of the identification characteristics, habitat, distribution, coloration, size and their venom of these fascinating creatures.

MATERIALS AND METHODS

Sea snakes were collected from Parangipettai coast (11° 50' N, 79° 48' E), Southeast coast India, Tamil Nadu (Fig. 1). Collections were made for a period of one year from Jan 2009 to Dec 2009. While operating trawlers, for fishing of prawns, crabs, etc., sea snakes were caught occasionally and brought to the landing centers by the fishermen. Collections were made intensively by visiting landing centers and picking up the dead snakes. Dead

snakes were caught from the gill net also (*Acrochordus sp.*). Sea

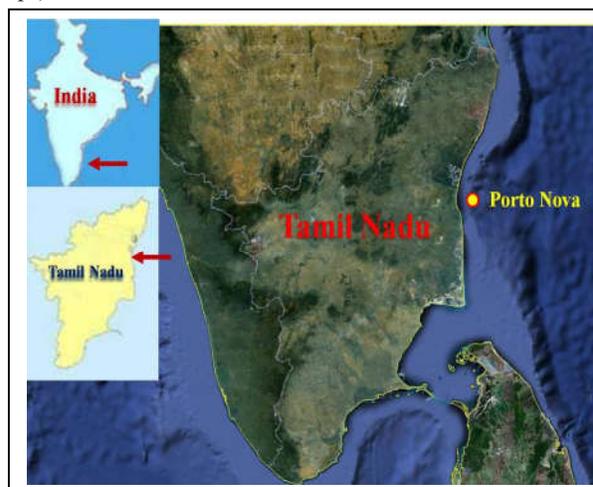


Fig 1. Study area

snakes was identified with the help of the key characters of given by (Smith, 1926, Murthy 1977, 1988, and 1992), (Lneich, 1996 Rasmussen, 1993, 1997 and Warrel, 1994). For identification snakes scales in head, ventral side is very important. Careful counting of scale with hand lens, colour, cross bands herpetologist was studied. Collection of sea snakes, in general, of any kind was a much-feared avocation and it is more so with the deadly sea snakes.

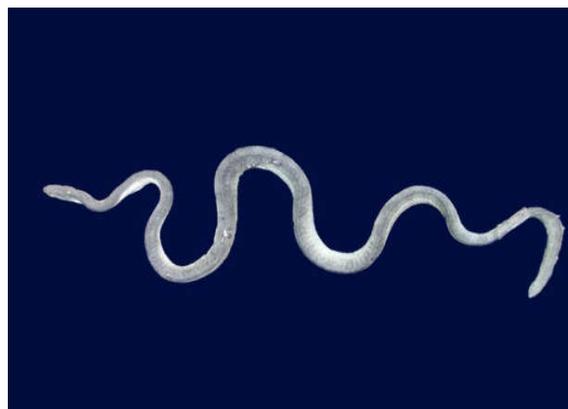
SYSTAEMATIC LIST

Class	:	<i>Reptilia</i>
Subclass	:	<i>Lepidosauria</i>
Order	:	<i>Squamata</i>
Suborder	:	<i>Serpentes</i>
Super family	:	<i>Xenophidia</i>
Family	:	<i>Elapidae :Hydrophiinae</i>

RESULT

There are five different genus coming under the Subfamily *Hydrophiidae* was collected from the present study area. i.e. *Enhydrina*, *Hydrophis*, *Lapemis*, *Pelamis* and *Laticauda*

Enhydrina schistosa (Daudin)



Sea snakes-Parangipettai coast
Fig. 2. *Enhydrina schistosa*

Beaked Sea Snake

Popular name; Valakadiyan (net biter).

Identification characteristics:

Rostral: Protrudes downwards. Frontal: Small
Supraoculars: Broad and nearly two thirds the area of the frontal. Parietals: The largest shields on the head of the snake and very prominent. Prefrontals: The entire system is shaped like the wings of a butterfly. Nasals: Triangular and the nostril is situated towards the posterior of the shield. Temporals: Entire and prominent, often touching the last four pairs of Supralabials. Supralabials: Eight pairs of which the last two are minuscule and may be absent. The third and fourth pairs touch the eye while the fifth pair may be divided. Infralabials: Five pairs of which the first pair is slender and elongated and replaces the mental shield. Sublinguals: May contain one amorphous pair. Ventrals:

Habitat: It is found in sandy or rocky bottom of the sea. It occurs in shallow open sea, river mouths, estuaries, coastal lagoons and mangrove forests. It is also seen in tidal creeks and other sheltered spots during monsoon. (Carpenter and Niem, 2001).

Distribution: It is distributed along the east coast of India, Southeast Asia and China to Australia (Samuel, 1944, Kasturirangan, 1951, Minton, 1975).

Coloration: Gray colour with 35 to 43 cross bands.

Status; Common

Size: Total length 1354 to 1550 mm; tail length 120 to 145 mm.

Venom: Neurotoxic venom (Gawade and Bhide, 1977, 1978, Geh and Toh, 1978, Gawade, and Gaitonde, 1980, 1982a, b).

***Hydrophis spiralis* (Shaw)**

Yellow sea snake (Fig. 3)



Fig. 3. *Hydrophis spiralis*

Identification characteristics:

Rostral: Pointed tips, Protrudes downwards. Frontal: Small
Supraoculars: small compared to frontal. Parietals: The largest shields on the head of the snake and very prominent. Prefrontals: broad, one third of frontal between two parietals. Nasals: Triangular and the nostril is situated towards the anterior of the shield. Preoculars: one scale and small Postoculars: one large compared to Preocular. Temporals: 1 anterior temporal prominent, often touching the last upper labials. Upper labials: Upper labial varies from 6 - 8. The 2nd scale touches the prefrontal while 3rd,

4th and 5th or only two of them touch the eye. 6-8 upper labials. Mental: upward triangle shape. Lower labials: The scales on lower labial are 4 in number and touch the chin. Sublinguals: 25-31 scale rows around neck Costals: scale row around the mid body 33-38. Ventrals: Ventrals 295-362, distinct throughout, about twice as broad as adjacent body scales. Small and often divided, falling into 230 to 361 rows.

Habitat: Warm shallow water reef area, deep waters and tidal rivers. It prefers only sea grass and sandy bottom (Karthikeyan and Balasubramanian, 2007).

Distribution: India, Persian Gulf, Oman, United Arab Emirates, Iran, Pakistan, Sri Lanka, Indonesia, Malaysia, Philippines, China, New Guinea (Karthikeyan and Balasubramanian, 2007).

Coloration: The head is yellow in colour but in young snakes it is blackish with yellow markings. The dorsal surface is golden yellow to yellow green in colour. The colour of the ventral surface is pinkish and the scales are with black margin. 41-46 narrow black bands encircle body.

Status; less common

Size: Total length 920 to 2895 mm; tail length 120 to 189mm.

Venom: Their venom is neurotoxic in nature. LD₅₀ dose of this species is 315mg/kg (Tu, 1987, 1988).

Scale counts: 25 to 31 scale rows on the neck, 33 to 38 scale rows around the thickest part of the body. 295 - 362 ventrals, are distinct throughout.

Maxillary teeth behind poison fangs - 6 to 7.

***Hydrophis cyanocinctus* (Daudin)**

Annulated Sea Snake (Fig. 4)



Fig. 4 *Hydrophis cyanocinctus*

Identification characteristics:

Morphological characteristics: Head is moderate body is elongate and not slender anteriorly with a gradual increase in girth posteriorly. Rostral Small protruding downward Frontal: cone shaped, sharp end towards parietals. Supraoculars: Relatively big compare with prefrontals. Prefrontals: highly compressed between the nasals and frontal. Parietals: Prominent and having groove on the top the scale. Nasals: Entire with the nostril situated at the outer rear frontals edge. Sublinguals: First pair even shapes and second pair irregular shape. ventrals 290-390 Karthikeyan et al., 2007 and Rufford Foundation, 2006.

Habitat: Shallow muddy water and mangrove swamps.

Distribution: India, Persian Gulf, Idzu Sea, Pakistan, Sri Lanka and Indonesia (Voris and Jayne, 1979).

Coloration: The ground colour is dirty white, pale greenish or yellow. The tail is darker in colour as compare to the rest of the body. The colour of the chin and throat is dark gray. The body is covered with sooty cross bands, which varies from 41 - 70 in numbers. The bands on mid dorsum are wider than the sides of the body. Similar bands are present on the tail, which vary from 6 - 9 in numbers.

Status: Common

Size: Total length 890 to 1930 mm; tail length 90 to 130 mm.

Venom: They are deadly venomous snakes. Their venom is neurotoxic in nature. LD₅₀ value of this species is 0.35 (mg/kg) (Karthikeyan *et al.*, 2007).

Scale counts: 27 to 35 scale rows on the neck, 37 to 47 scale rows around the thickest part of the body. 290 - 390 ventrals, are distinct throughout. Maxillary teeth behind poison fangs: 5 or 6

***Hydrophis gracilis* (Shaw)**

Common small headed sea snake (Fig. 5)



Fig. 5. *Hydrophis gracilis*

Identification characteristics:

Rostral: Long touches nasals. **Frontal:** Frontal and Supraocular are equal size. **Supraoculars:** Shapes differ from frontal. **Parietals:** Large, cone shape and very prominent. **Prefrontals:** Prefrontal in contact with third upper labial and nasal. **Nasals:** Inter nasal absent, large size compared to Prefrontals. **Preoculars:** One and small size. **Postoculars:** One large compared to preocular. **Temporals:** Entire and prominent, one temporal broad. **upralabials:** Five pairs all are equal size. The second pairs touch the eye. **Mental:** Exact triangle shape. **Infralabials:** Six pairs of which the second and six pare smaller. Sixth pair is narrow and elongated. **Genials:** May contain two pair. First pair is small compared to second pair. **Ventrals:** Small and often divided falling into 220-287 rows. Ventrals divided by a longitudinal fissure.

Habitat: Warm shallow and deep waters (Murphy, 1999).

Distribution: Indian, Sri Lanka, Thailand, Malaysia, Vietnam, China, Taiwan, Indonesia, Australia, Melanesia and Myanmar (Murphy, 1999; Karthikeyan and Balasubramanian, 2007).

Coloration: Bands are 40-60 posteriorly, with age the markings disappear. Adult is usually grayish above, paler in the ventral side.

Status: Rare

Size: Total length 1904 to 2412mm; tail length 245 to 270mm.

Venom: Their venom is neurotoxic in nature (Tu, 1987, 1988).

Scale counts: 17 to 21 scale rows around the neck; 30 to 36 scale rows around the body; 220 to 287 ventrals. Ventrals are entire on the slender portion of the body and completely divided in the posterior region by a median longitudinal fissure. Maxillary teeth behind poison fangs - 5 or 6

***Hydrophis caeruleus* (Shaw)**

Many toothed sea snake (Fig. 6)

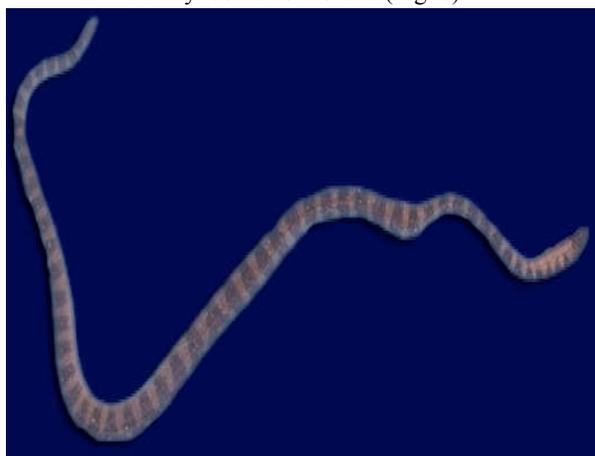


Fig. 6. *Hydrophis caeruleus*

Identification characteristics

Rostral: It is small size but protrudes downwards with sharp end. **Frontal:** Hexagonal shape. **Blind at pre frontal side sharp end at parietal side.** **Supraoculars:** hexagonal shape, curve in the eye side. **Parietals:** Even and rectangular shape touches the lower end to form a triangle. **Prefrontals:** it is long ending between the preocular and nasal scales contact with pre and Supraocular scales. **Prefrontal** usually in contact with second upper labial. **Nasals:** It occupies large area less space for rostral. **Blind** triangular shape towards the rostral. **Nasals** in contact with one another. **Nasal hole** touches the end line of prefrontal, in that area nasal scale is having bent. **Preoculars:** Small, triangular shape and it touch with third upper labials. **Postoculars:** Two pair in both side upper scales larger compares to lower. **Temporals:** In this species one side upper temporal 2 and other side 3 scales.

Habitat: It inhabits at shallow seas and muddy creeks with mangrove swam (Murphy, 1999). **Distribution:** India, Straits of Malacca to the Gulf of Siam, Southeastern China, Western Indonesia, Myanmar, Mergui Archipelago and Karachi coast (Murphy, 1999).

Coloration: Head small; anterior part of body is slender; body looks gray dorsally and ventrally with yellow color; 35 to 58 deep gray with black bands, Broad irregular bands occasionally present; adults often lack any pattern and are uniform olive to dark gray; head looks pale olive to gray.

Status: Common

Size: Total length 874 to 1358 mm; tail length 84 to 110 mm.

Venom: Neurotoxin (Tu, 1987 1988).

Lapemis curtus (Shaw)
Short Sea Snake (Fig. 7)



Fig. 7. *Lapemis curtus*

Identification characteristics:

Head is large, body short and robustly built in comparison to most other sea snake species. Parietal scales are usually fragmented. Ventrals are difficult to discern. Rostral: From the dorsal view it is small size but protrudes downwards large part. Frontal: Large and hexagonal shape. Supraoculars: Half round shape. Parietals: The only sea snake with parietal shield on head broken up into small pieces. Both scales are not in even shape. Prefrontals: Contact with pre and supraocular scales. Smaller than nasals. Prefrontal usually in contact with second upper labial. Nasals: It occupies large area less space for rostral. Triangular shape towards the rostral. Nasals in contact with one another. Preoculars: One Preocular touch with third upperlabials. Postoculars: 1 or 2 Postoculars. Temporals: 2, rarely 3, anterior temporals. Supralabials: 7–8 upper labials 3–4 bordering eye. Mental: Heart shape. Infralabials: Four pairs of which the third and fourth pairs are bigger Karthikeyan and Balasubramanian, 2007 and Lobo, 2006.

Habitat: Found mainly in marine water varying from clear (above coral reefs) to silty shorelines and turbid estuaries; in near-shore marine waters of Persian Gulf, & northern Indian and southwestern Pacific Oceans.

Distribution: Persian Gulf, India, Asia, Philippines, Karachi, New Guinea and Australia (Gritis, and Voris 1990; Rasmussen and Andersen, 2000; Porter et al., 1997; Bussarawit et al., 1989).

Coloration: Green or yellow- olive above, whitish below, 35–50 olive to dark gray dorsal bands, tapering to a point laterally, occasionally encircling body, a narrow dark ventral stripe or broad irregular band occasionally present; adults often lack any pattern and are uniform olive to dark gray.

Status: Most common snake

Size: Total length 690 to 985 mm; tail length 64 to 104 mm

Venom: neurotoxic and myotoxic factors, LD₅₀ value of this snake is 0.62 (mg/kg) in mouse (Bergman, 1949).

Scale counts: 23 to 35 scale rows around the neck; 25 to 43 scale rows around the body; 114 to 230 ventrals, which

are not distinct throughout. Large individuals have spiny scutes on their ventral scales belly scales (Lobo, 2006) Maxillary teeth behind the poison fangs – 3 to 6

Pelamis platurus (Linnaeus)
Pelagic, yellow bellied sea snake (Fig. 8)



Fig. 8. *Pelamis platurus*

Identification characteristics:

Head elongate; snout bill-like and flattened; gap of mouth very wide. Normal colour pattern with yellow on ventral side and black on dorsal side (Linnaeus, 1766) Prefrontals: Prefrontal is having contact with second upper labial. Nasals: nasal shields in contact with one another Loreals: Absent. Preoculars: 1-2 pairs. Postoculars: 2-3 pairs Temporals: 2–3 small anterior temporal. Infralabials: 7–8 upper labials, 4–5 below eye but separated from border by sub ocular. Ventrals: ventral scales, 264–406, very small and, if distinct, divided by a longitudinal groove, but usually indistinguishable from adjacent body scales

Habitat: They are usually found within a few kilometers of the coast and prefer shallow inshore waters. Normally these snakes live in waters with temperatures between 11.7 and 36 °C (Klawe, 1964 and Kropach, 1975).

Distribution: Indian and Pacific oceans, Madagascar, Arabia, Asia, Indonesia, Japan, Australia, New Zealand, and the Pacific Islands (Dunson, 1975, Graham et al., 1987, 1987a).

Coloration: Color variable but most often distinctly bicolored, black dorsal, yellow or brown ventral side, the dorsal and ventral colors sharply demarcated from one another ventrally there may be a series of black spots or bars on the yellow or brown background, or the yellow may extend dorsally so that there is only a narrow middorsal black stripe, or a series of black crossbars noticed.

Status: Common

Activity and Behavior: Usually floats among flotsam or floating seaweed at the surface in tropical or subtropical zones of the Pacific & northern Indian Oceans. Captures small fish that happen near via a quick sideways lunge. Quite inoffensive, but when restrained or when stranded on a beach it will bite to defend itself.

Size: Total length 535 to 1020 mm; tail length 95 to 120 mm

Venom: Highly potent venom containing post-synaptic neurotoxins. Most natural marine predators, like predatory fish & even sharks, usually avoid this snake. Scavengers

also tend to avoid specimens which have been washed up onto a beach & are dying.

Scale counts: 49 to 67 scale rows around the body; 264 to 406 ventrals are broken up or identical to the adjacent scales. Maxillary teeth behind the poison fangs – 7 to 11.

Laticauda colubrina (Schneider)
Yellow-Lipped Sea Krait (Fig. 9)



Fig. 9. *Laticauda colubrina*

Identification characteristics:

Sea kraits have a cylindrical body shape with a laterally compressed, paddle-like tail. They are distinctly banded with 20-65 black bands on a usually blue-gray body. These bands extend from the neck area to the tip of the tail. The ventral (bottom) surface of the body is usually lighter than the top. The black head has yellowish accents.

Habitat: Sea kraits are unique among sea snakes. They are amphibious, able to live on land or in the ocean. However, they are most commonly found in shallow tropical marine environments, coral reefs and mangrove swamps to a maximum depth of 10 m (33 ft). On land they inhabit sandy beaches, coral islands, and occasionally low hanging trees.

Distribution: Coastal waters of New Guinea, Pacific islands, Philippines, Southeast Asia, India, Sri Lanka, and Japan. (Cogger, 2000, Cogger and Heatwole, 2006)

Coloration: Body bluish-gray whitish or black crossbands which often encircle whole body; belly whitish to cream (w/ expanded scales or scutes), front of head w/ a broad cream or whitish band (from one eye around to the other) which includes both lips. Tail "oarlike." (Armed Forces Pest Management Board/ Venomous Animal and Plant, Last Major update: Feb -2008)

Size: Adult males can reach 75 cm (30 in). Female are significantly larger than males, reaching 128 cm (50 in) in length.

Venom: Sea krait affects both muscles and nerves.

Acrochordus granulatus
Non poisonous (Fig. 10)

Strictly aquatic snakes showing many of specialization seen in Hydrophiidae. Nostrils are dorsal, scales on top of head small and granular, point of chin with projection fitting into deep notch in upper jaw, body skin loose, scales juxtaposed and tuberculate, no ventrals, tail short, round or nearly so.



Fig. 10. *Acrochordus granulatus*

These snakes are inhibited in both fresh and salt water. The family contains a single genus, *Acrochordus*, including two species. Head flat, not distinct from neck, small, covered with granular and tuberculated scales 8 to 11 scales on a line between eyes, a series of enlarged scales on the lips separated from the border of the mouth by smaller scales, about 100 scales on the middle of the body 60 to 63 black bands are present on the body. Well define nostrils are present on the head.

The color pattern of this snake, dark grey to black with white cross bands. Many of snakes become confluent near the mid body and disappear. The Indian water snake is usually found in salty or brackish water of the river mouth and coasts. Commonly occur in rainy season at Vellar estuary.

Cerberus rhynchops

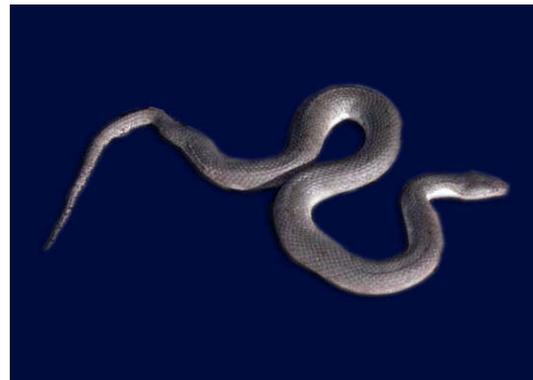


Fig. 11. *Cerberus rhynchops*

This dog face snake comes under Colubridae, head is small, barely distinct from neck, eye small, with vertically elliptical pupil. Dog's face appearance of this snake due to the prominent lower jaw. Snake's body stout, cylindrical, with strongly keeled scales in 23- 25 rows. Tail short tapering and slightly compressed but tail found to be terrestrial snake. Maximum total length was 1m. Grey, brown, olive or olive or blackish above, with more or less distinct black spots or cross bars and greenish or yellowish below, with black bars or spot. This species is usually found in the brackish water of tidal rivers creeks, lagoons, and estuaries (Fig. 11).

Swims powerfully but is often seen anchored by its tail and swaying in the flow awaiting for fish passing by in

shallow water flukes its tail to frighten fish towards its head. Often climbs on to the water when disturbed, in spite of its forbidding appearance it is a inoffensive reptile, biting only under grave provocation. Emits an unpleasant odour under great excitement. It has a curious sidwinder movement on land.

ACKNOWLEDGEMENT

We are grateful and thank to Dr. T. Balasubramanian, Director, Faculty of Marine Science, Annamalai University for providing facilities throughout the present study.

REFERENCES

- Acott, C., Williamson, J., 1996. Sea snake. In: Williamson, J.A., Fenner, P.J., Burnett, J.W., Rifkin, J.F., (Eds.), *Venomous and Poisonous Marine Animals: A Medical and Biological Handbook*. UNSW Press, Sydney, pp. 396-402.
- Bussarawit, S., Rasmussen, A.R. and Andersen, M., 1989. A preliminary study on sea snakes (Hydrophiidae) from Phuket Harbour, Phuket Island, Thailand. *Nat. Hist. Bull. Siam Soc.*, 37: 209-225.
- Carpenter, K.E. and Niam, V. H. 2001 *The Living Marine Resources of the Western Central Pacific. Volume 6; Bony Fishes Part 4 (Labridae to Latimeriidae), Estuarine Crocodiles, Sea Turtles, Sea Snakes and Marine Mammals*, Food and Agriculture Organisation of the United Nation, Rome.
- Cogger, H.G. and H.F. Heatwole, 2006 *Laticauda frontalis* (de Vis, 1905) and *Laticauda saintgironsi* n.sp. from Vanuato and New Caledonia (Serpentes: Elapidae: Laticaudinae)- a new lineage of sea kraits? *Records of the Australian Museum* 58:245-256
- Cogger, H.G., 2000. Reptiles and Amphibians of Australia, 6th ed. Ralph Curtis Publishing, *Sanibel Island*, 808 pp.
- Dunson, W.A., 1975. Adaptation of sea snakes, pp. 3-19. In: Dunson, W.A. (ed.) *The Biology of Sea Snakes*. University Park Press, Baltimore, 530pp.
- Dunson, W.A., 1975. Sea snakes of tropical Queensland between 18 and 20 south latitude. In: Dunson, W.A. (Ed.), *The Biology of sea snakes*. University Park Press, Baltimore, pp.151-162.
- Fry, G.C., Milton D.A., and Wassenberg, T.J., 2001. The reproductive biology and diet of seasnake by-catch of prawn trawling in northern Australia: characteristics important for assessing the impact on population. *Pacific Conservation Biology*, 7: 55-73.
- Gawade, S.P., Bhide, M.B., 1977. Chromatographic separation of the venom of *Lapemis curtis* and pharmacological characterization of its toxic components. Preliminary studies. *Int. Symp. Venoms Toxins*, Bombay, India, p. 35.
- Gawade, S.P., Bhide, M.B., 1978. Chromatographic separation of the venom of *Enhydrina schistosa* (common sea snake) and characterization of the principal toxic component. *Indian J. Med. Res.*, 67: 845-861.
- Gawade, S.P., Gaitonde, B.B., 1980. Immunological studies on monovalent *Enhydrina schistosa* antivenin. *Indian J. Med. Res.*, 72: 895-900.
- Gawade, S.P., Gaitonde, B.B., 1982a. Presynaptic and postsynaptic sites of action of enhydrotoxin-a (ESNTX-a) isolated from *Enhydrina schistosa* venom. *J. Pharm. Pharmacol.* 34: 782-787.
- Gawade, S.P., Gaitonde, B.B., 1982b. Isolation and characterization of toxic components from the venom of the common India sea snake (*Enhydrina schistosa*). *Toxicon*, 20: 797-801.
- Geh, S.L., Toh, H.T., 1978. Ultrastructural changes in skeletal muscle caused by a phospholipase A2 fraction isolated from the venom of a sea snake *Enhydrina schistosa*. *Toxicon*, 16: 633-643.
- Glodek, G.S., and Voris, H.K., 1982. Marine snake diets: prey composition, diversity and overlap. *Copeia*, 1982: 661-666.
- Gow, G. F., 1977. *Snakes of the Darwin Area*, Museum and Art Galleries board of the Northern Territory, NT, *Australia*. p 29.
- Graham, J.B., Lowell, W.R., Rubinoff, I. and Motta, J., 1987a. Surface and subsurface swimming of the sea snake *Pelamis platurus*. *J. Exp. Biol.*, 127:27-44.
- Gritis, P., Voris, H.K., 1990. Variability and significance of parietal and ventral scales in marine snakes of the genus *Lapemis* (Serpentes: Hydrophiidae) with comments on the occurrence of spiny scales in the genus *Fieldiana*, *Zool.*, 56: 1-13.
- Haile, N.S., 1958. The snakes of Borneo, with a key to the species. *Sarawak Museum Journal*, 8: 743-771.
- Heatwole, H., 1997. Marine snakes: are they a sustainable resource? *Wildlife Society Bulletin*, 25: 766 – 772.
- Heatwole, H., 1999. *Sea Snakes*. UNSW Press, Hong Kong.
- Ineich, I., Laboute, P., 2002. *Sea Snakes of New Caledonia*. Institute de Recherché pour le Développement. Muséum National d'Histoire Naturelle, Paris. 301 pp.
- Karthekeyan, R., and Balasubramanian, T., 2007. Species Diversity of the Sea Snake (Hydrophiidae) Distributed in the Coramantal Coast (East Coast of India) *International Journal of Zoological Research*, 3 (3): 107- 131.
- Karthekeyan, R., Karthigayan, M., Sri Balasubashini, M., Vijayalakshmi, S., and Balasubramanian, T., 2007. Inhibition of Cancer Cell Proliferation in vitro and Tumor Growth in vivo by *Hydrophis spiralis* Sea Snake Venom *International Journal of Cancer Research*, 3(4): 186-190.
- Karthekeyan, R., Vijayalakshmi, S. and Balasubramanian, T., 2008. Feeding and parturition of female annulated sea snake *Hydrophis cyanocinctus* in captivity. *Current Science*, 94: 660-664.
- Kropach, 1975. The yellow-bellied sea snake, *Pelamis*, in the eastern Pacific. In *The biology of sea snakes* (W. Dunson, Ed.). *Baltimore, Maryland, Univ. Park Press*. 185-213.
- Lim, F.L. K., and Lee, M. T. M., 1989. Fascinating snake of Southeast Asia. *Tropical Press Sdn. Bhd.*, Kuala Lumpur.
- Lneich, 1996. Geographic distribution –Serpentes. *Hydrophis rorquatus diadema*. *Herpetol. Rev.*, 27(3):15.
- Lobo, A.S. 2006. *Sea Snakes of the Gulf of Mannar Marine National Park. The Species and their conservation*. Technical Report submitted to the Rufford Foundation

- Mora, R., Valverde, B., Dı'az, C., Lomonte, B. and Gutie'rrez, J.M., 2005. A Lys49 phospholipase A2 homologue from *Bothrops asper* snake venom induces proliferation, apoptosis and necrosis in a lymphoblastoid cell line Toxicon, 45: 651-660.
- Murphy, J. B., 1977. An unusual method of immobilizing avian prey by the dog-toothed cat snake, *Boiga cynodon*. Copeia, 1977(1): 182-184.
- Murphy, J.C., M.J. Cox and H.K. Voris, 1999. A key to the sea snakes in the gulf of Thailand. Nat. Hist. Bull. Siam. Soc., 47: 95-108.
- Murthy, T.S.N., 1977. On sea snake occurring in Madras Waters. J.Mar. Biol. Ass. India., 19: 68-72.
- Murthy, T.S.N., 1986. *The snake book of India*. International Book Publishers.
- Murthy, T.S.N., 1999. Marine reptiles of India: An Overview contribution of herpetology. Herpetologica, 58(2): 35-38.
- Murthy, T.S.N. 1992, Marine Reptiles of India; An overview Contribution in Herpetology. P35-38.
- Porter, R., Irwin, S., Irwin, T., and Rodrigues, K., 1997. Records of marine snake species from the Hey-Embley and Mission Rivers, far North Queensland. Herpetofauna, 27: 1-7.
- Rasmussen, A. R. 1993. The status of the Persian Gulf Sea snake *Hydrophis lapemoides* (Gray, 1984) (Serpentes, Hydrophiidae). BULL. Brit. Mus. Natl. Hist.(Zool. Ser.), 59 (2):97-105.
- Rasmussen, A. R., and L. Smith. 1997. The taxonomic status of the Sea snake *Hydrophis ezeblukovi* (kharin, 1984) from north-west Australian waters. Amphibia-Reptilia, 18: 419-425.
- Rasmussen, A.D., Andersen, O., 2000. Effects of cadmium exposure on volume regulation in the lugworm, *Arenicola marina*. Aquat. Toxicol., 48: 151-164.
- Rasmussen, A.R. 2001. Sea Snakes, pp. 3987-4008. In: Carpenter, K.E. & V.H. Niem (eds.). *FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific. Volume 6. Food and Agricultural Organization, Rome*.
- Reynolds, R.P. and Pickwell, G.V., 1984. Records of the yellow-bellied sea snake, *Pelamis platurus*, from the Galapagos Islands. Copeia, 1984: 786-789.
- Sedgwick, A., 1905. *A students text book of zoology*. Trinity College, Cambridge, Vol.II. pp. 83-130.
- Senanayake, M.P., Ariarane Ariaratnam, C.A., Abeywickrema, S. and Belligaswate, A., 2005. Two Sri Lankan cases of identified sea snake bites, without envenoming. Toxicon, 45: 861-863.
- Shetty, S., and Shine R., 2002. The mating system of yellow-lipped sea kraits (*Laticauda colubrina*, Laticaudidae). Herpetologica, 58: 170-180.
- Shuntov, V.P., 1971. Sea snakes of the north Australian shelf (in Russian). *Ekologiya* 2: 65-72.
- Smith, M., 1926. Monograph of the sea snake (Hydrophiidae). Trustees of the British Museum (London), pp. 1-130.
- Tu, A.T., 1987. Biototoxicology of sea snake venoms. Annal. Emerg. Med., 16: 149-154.
- Tu, A.T., 1988. Pharmacology of sea snake venoms. In: *Poisonous and Venomous marine animals of the world*, B.W. Halstead (Ed), Darwin Press, Princeton, 235- 258.
- Tweedie, M. W. F., 1941. Poisonous animals of Malaya. Malaya Publishing House, Limited, Singapore. Publications, Kota Kinabalu, Sabah. 254 p.
- Verma, P.K. and Pande, N., 2004. *Latest portfolio of theory and practice in reptelia*. Dominant Publishers and Distributors, New Delhi.
- Voris, H. K., 1972. The role of sea snakes (Hydrophiidae) in the trophic structure of coastal ocean communities. J. Mar. Biol. Assn. India., 14: 1-14.
- Voris, H.K., and Jayne, B.C., 1979. Growth, reproduction and population structure of a marine snake, *Enhydrina schistosa*. Copeia, 1979: 307-318.
- Voris, H.K., and Voris, H.H., 1983. Feeding strategies in marine snakes: an analysis of evolutionary, morphological, behavioral and ecological relationships. American J. Zool, 23: 411-425.
- Warrel, D. A., 1994. Sea snake bites in the Asia- Pacific region. In *Sea snake toxinology*, edited by P. Gopalakrishnkone. Singapore University Press, pp. 1-36
- Wassenberg, T.J., Salini, J.P. , Heatwole, H., and Kerr, J.D., 1994. Incidental capture of sea snakes (Hydrophiidae) by prawn trawlers in the Gulf of Carpentaria, ustralia. Australian Journal of Marine and Freshwater Research, 45: 429-443.
- Yang, R.S., Tang, C.H., Chuang, W.J., Huang, T.H., Peng, H.C., Huang, T.F. and Fu. W.M., 2005. *Inhibition of tumor formation by snake venom disintegrin*. Toxicon, 45: 661-669.
- Zann, L.P., R.J. Cuffy & C. Kropach 1975. Fouling organisms and Parasites associated with the skin of sea snakes, pp. 251-265. In: Dunson, W.A. (ed.). *The Biology of Sea Snakes*. University Park Press, B
